

Remarks

The Examiner has objected to the amendment filed April 6, 2004 as containing new matter. The objectionable language asserted as new matter is "a hydrophobic matrix polymer and a hydrophilic non-ionic polymer wherein said proton-conducting membrane is a single-phase, substantially non-porous structure" as generally recited in amended Claims 31 and 60. Based on this new matter, Claims 31-60 were rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The Applicants respectfully traverse the objection to the April 6, 2004 amendment and rejection of Claims 31-60 and provide the following references to the specification that describe and enable the referenced claim limitations.

The Examiner correctly stated that the "combination of [hydrophobic and hydrophilic] polymers, analogous to oil and water, would not be expected by one of ordinary skill in the art to be mutually soluble or to form a single phase." (June 28, 2004 Final Office Action, p. 3). However, this surprising single-phase result is one aspect of the present invention specifically noted by the Applicants in paragraph [0078].¹

The specification describes and enables several examples of hydrophobic matrix polymers known to one of ordinary skill in the art, including polyvinylidene fluoride (PVDF) and polyvinylidene fluoride co-hexafluoropropylene (PVDF-HFP), in paragraphs [0101], [0103], [0241], and [0242]. The specification also describes and enables several examples of hydrophilic non-ionic polymers known to one of ordinary skill in the art,

¹ "We have surprisingly found that certain combinations of highly polar polymers (that are in some cases water-soluble), being to a certain degree compatible with relatively hydrophobic polymers, can synergistically form films having particularly selective proton conducting properties." Specification, paragraph [0178].

including polyvinylpyrrolidone (PVP), in paragraphs [0102], [0133] - [0140], [0243], and [0244]. Therefore, references to PVDF or PVDF-HFP as a hydrophobic polymer and to PVP as a hydrophilic non-ionic polymer, while not intended to limit the scope of the invention to these particular polymers, are both described and enabled by the specification and known to one of ordinary skill in the art.

The specification further describes and enables the combination of a hydrophobic matrix polymer with a hydrophilic non-ionic polymer to produce a single-phase membrane in paragraphs [0141] – [0144], [0186] – [0188], and [0215]. As specifically described in paragraph [0215], a hydrophobic polymer (e.g., 66% PVDF) may be dissolved with a hydrophilic polymer (e.g., 34% PVP) in a common solvent such as N-methyl pyrrolidinone (NMP). The resulting solution is cast on a substrate, and the solvent is evaporated to produce a single-phase membrane. The specification provides additional examples of suitable ratios for combining hydrophobic and hydrophilic polymers to form a single-phase membrane in paragraphs [0245] – [0253], [0257] – [0268], and [0271]. Therefore, the specification fully describes and enables to one of ordinary skill in the art the combination of hydrophobic and hydrophilic polymers to produce a single-phase membrane.

The specification describes the resulting membrane (formed from the combination of the hydrophobic and hydrophilic polymers in a common solvent and subsequent evaporation) in paragraphs [0188], [0192], and [0202]. As described in paragraph [0188], the interactions between the hydrophobic (PVDF) and hydrophilic (PVP) polymers produce a membrane having different physical characteristics, such as melting point and optical clarity, than the individual constituent polymers. Therefore, the

characterization of the membrane as a single-phase membrane, as stated in paragraphs [0192] and [0202], is described and enabled to one of ordinary skill in the art.

For at least the reasons set forth above, the Applicants respectfully submit that the April 6, 2004 amendments are fully described and enabled by the original specification to one of ordinary skill in the art. In as much as the previous prior art rejections have been withdrawn in view of the April 6, 2004 amendments, the Applicants respectfully submit that all pending claims are now allowable, including previously withdrawn Claims 34-36, 41-45, and 50-55. Should any issues remain after consideration of this amendment, then Examiner Chaney is invited and encouraged to telephone the undersigned at her convenience.

Respectfully submitted,

September 28, 2004



Steven R. LeBlanc
DORITY & MANNING, P.A.
P.O. Box 1449
Greenville, SC 29602
(864) 271-1592
(864) 233-7342